External Fetal Monitoring

How the Machine Should Go

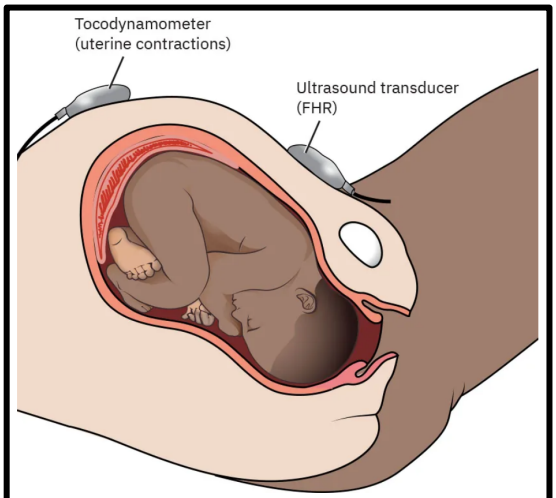
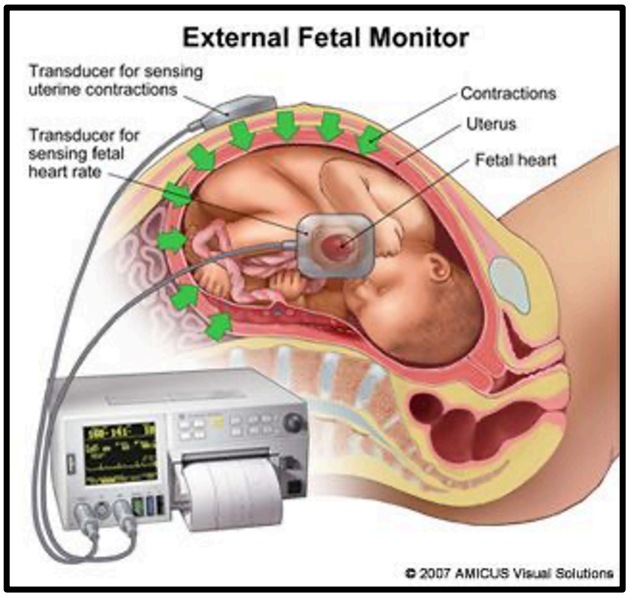


Figure 16.19 Placement of External Fetal Monitors The tocodynamometer is placed on the upper uterus (fundus), and the ultrasound transducer is placed over the fetal back. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)



What the Squiggly Lines Means

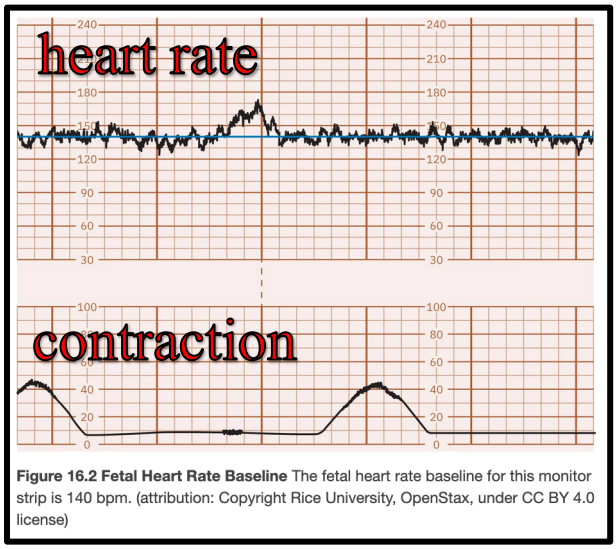
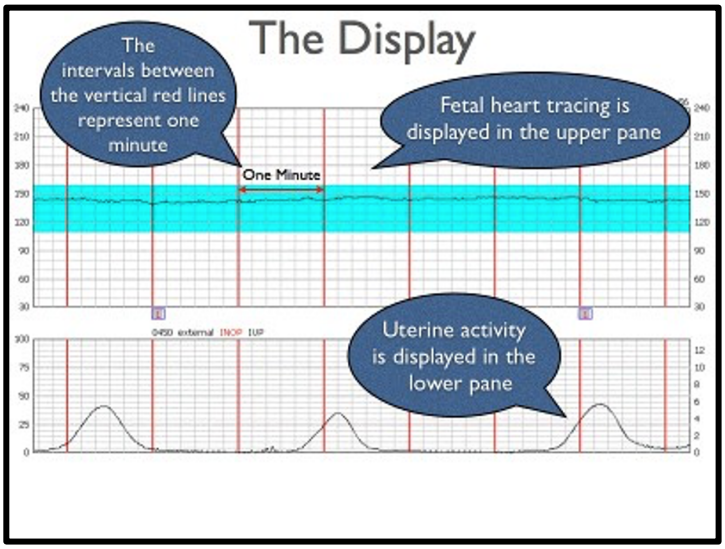


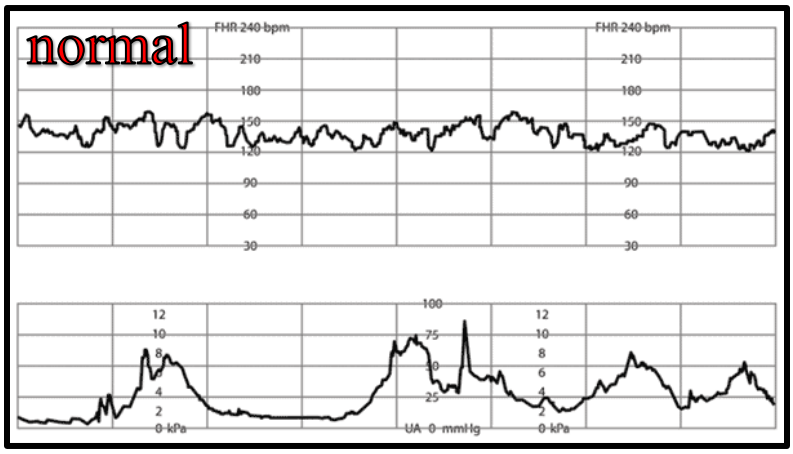
Figure 16.2 Fetal Heart Rate Baseline The fetal heart rate baseline for this monitor strip is 140 bpm. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)


The Display
The intervals between the vertical red lines represent one minute
Fetal heart tracing is displayed in the upper pane
One Minute
Uterine activity is displayed in the lower pane

Describing the Fetal Heart Rate (FHR)

- Interpretation should be done over a 10min window
- Strip initially described by "rate" and "variability"
    - Rate must be sustained out of range to be considered tachycardia or bradycardia
    - Variability described as:
        - Absent: amplitude range undetectable
        - Minimal: amplitude range detectable, but ≤5bpm
        - Moderate: amplitude range 6-25bpm
        - Marked: amplitude range >25bpm

- Normal Fetal Heart Rhythm
    - FHR 110-160bpm
    - Moderate variability
    - ***No action indicated***



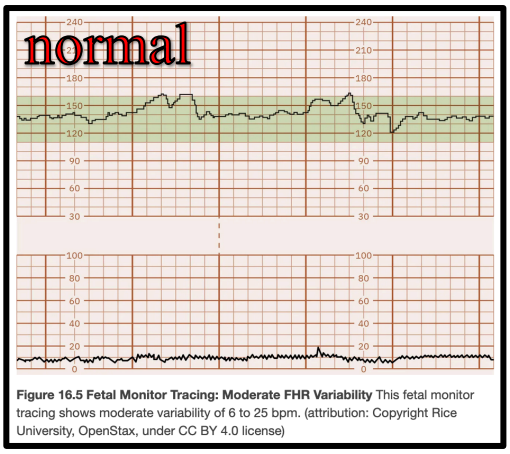
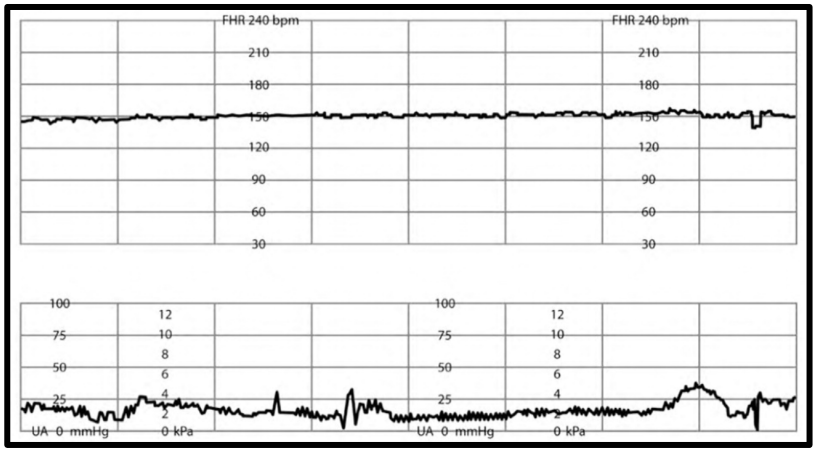


Figure 16.5 Fetal Monitor Tracing: Moderate FHR Variability This fetal monitor tracing shows moderate variability of 6 to 25 bpm. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Minimal Variability
    - FHR amplitude range detectable, but ≤5bpm
    - Mom causes: medications (i.e., magnesium, betamethasone), substances (i.e., cocaine), general anesthesia, fever
    - Baby causes: acidosis, hypoxia, sleep, CNS abnormality, preterm
    - ***Action: determine if pathological***
        - ***May be normal/ may not indicate pathophysiology (i.e., fetal sleep)***
        - ***Consider cause and treat if needed with oxygen, maternal resuscitation, delivery, etc.***



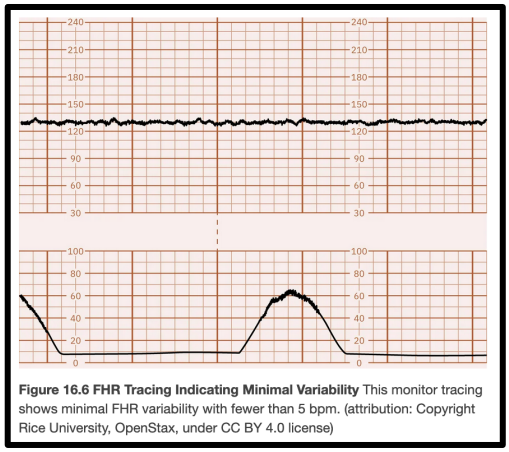
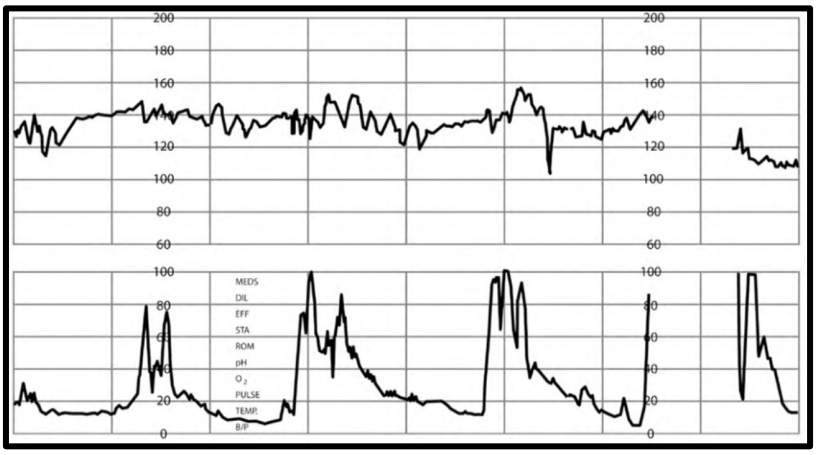


Figure 16.6 FHR Tracing Indicating Minimal Variability This monitor tracing shows minimal FHR variability with fewer than 5 bpm. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Marked Variability
    - FHR amplitude range >25bpm
    - Cause: fetal hypoxia, fetal stimulation
    - ***Action: determine if pathological***
        - ***May be normal/ may not indicate pathophysiology (i.e., fetal stimulation, movement, etc.)***
        - ***Consider cause and treat if needed with oxygen, maternal resuscitation, delivery, etc.***



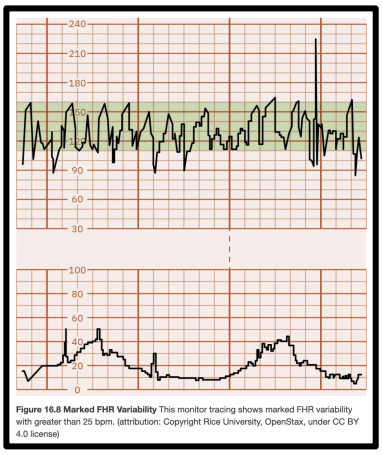


Figure 16.8 Marked FHR Variability This monitor tracing shows marked FHR variability with greater than 25 bpm. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

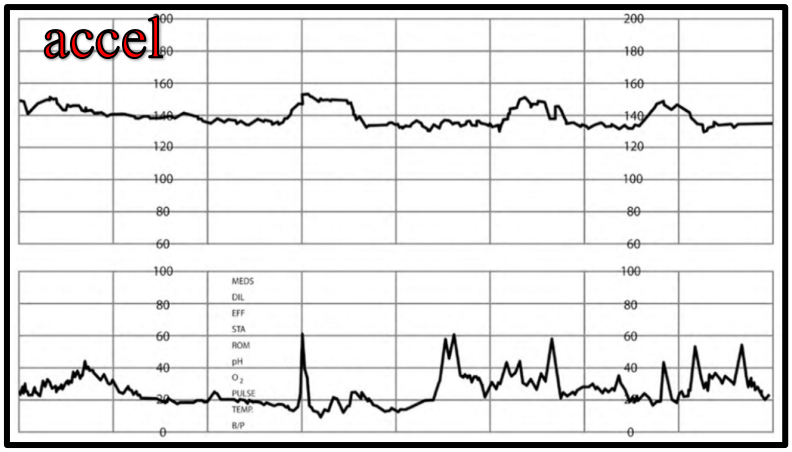
- Tachycardia/ Elevated Fetal Heart Rate
    - FHR over 160bpm (for 10min or more)
    - Mom causes: fever/ infection (most common overall cause), anemia, anxiety, dehydration, stimulants
    - Baby causes: hypoxia/ fetal compromise, anemia, cardiac defects, prolonged activity (i.e., exhaustion), severe prematurity
    - ***Action: consider cause and treat with oxygen, maternal resuscitation, antibiotics, etc.***

- Bradycardia/ Decreased Fetal Heart Rate
    - FHR under 110bpm (for 10min or more)
    - Mom causes: hypoglycemia, hypotension, hypothermia, vagal stimulation
    - Baby causes: cord compression, hypoxia, cardiac defects, post-term
    - ***Action: consider cause and treat***
        - ***for mom: dextrose, resuscitation, warmth, etc.***
        - ***for baby: reposition, oxygen, treat mom, etc.***

Describing & Correlating Contractions

- Contractions seen as peaks along the toco tracing
- FHR response to contraction described as:
    - Acceleration (increase)
    - Deceleration (decrease)
        - Early
        - Late

- Acceleration
    - Visually apparent, abrupt (onset to peak <30s) increase in FHR from the most recently calculated baseline; peak ≥15bpm above baseline, duration ≥15s, but <2min from onset to return to baseline
        - <32wks: peak ≥10bpm above baseline, duration ≥10s
    - Occur with fetal movement, uterine contractions, fetal scalp stimulation, and acoustic stimulation; accelerations are a reassuring indication of fetal well-being
    - ***No action indicated***



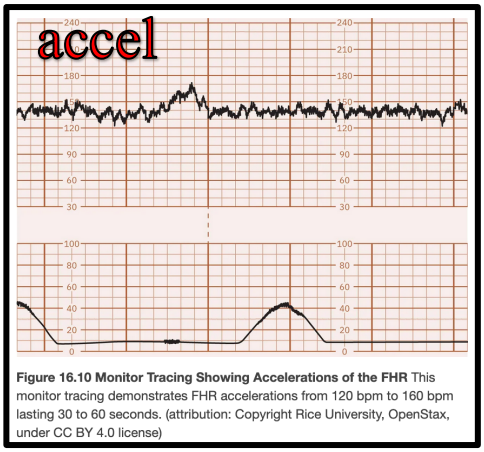
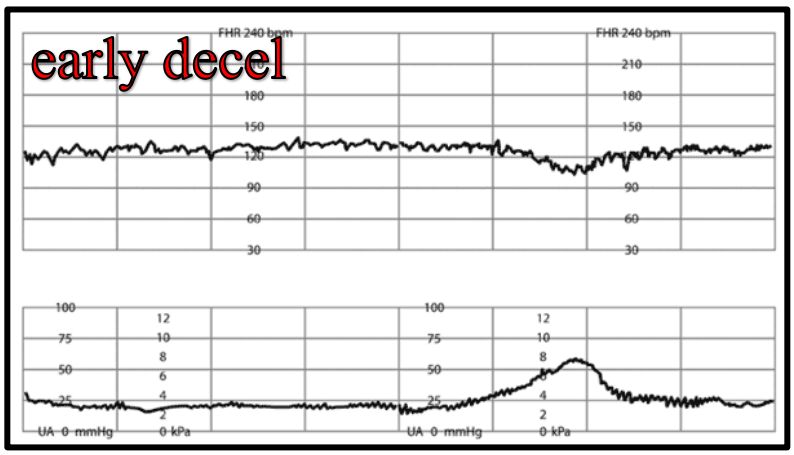


Figure 16.10 Monitor Tracing Showing Accelerations of the FHR This monitor tracing demonstrates FHR accelerations from 120 bpm to 160 bpm lasting 30 to 60 seconds. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Early Decelerations
    - The nadir of the deceleration occurs at the same time as the peak of the contraction
    - Also known as "head compressions" – caused by fetal head compression (and increase in ICP) during uterine contraction, resulting in vagal stimulation and bradycardia
    - Reassuring sign, not associated with fetal distress
    - ***No action indicated***



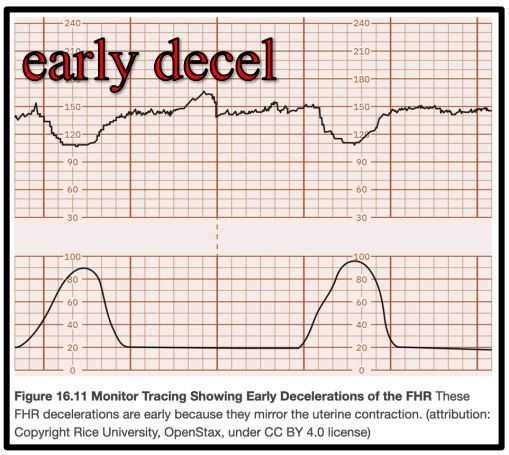
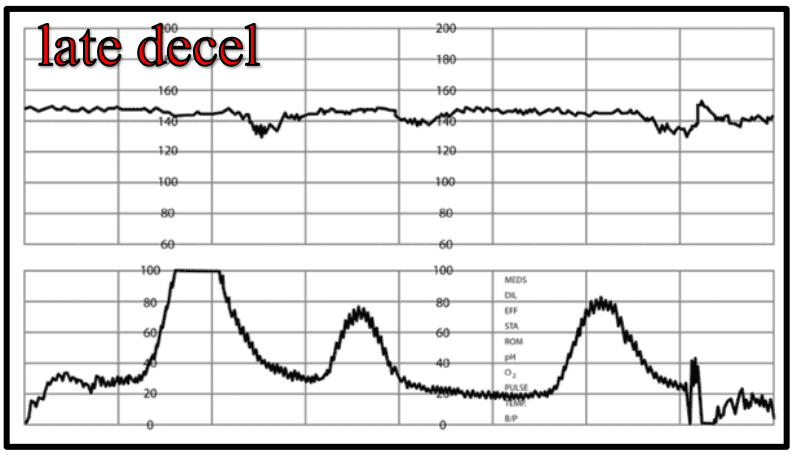


Figure 16.11 Monitor Tracing Showing Early Decelerations of the FHR These FHR decelerations are early because they mirror the uterine contraction. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Late Decelerations
    - The onset, nadir & recovery of the deceleration occurs after the onset, peak & end (respectively) of the contraction
    - Also known as "uteroplacental insufficiency" – caused by decreased uterine blood flow
    - Non-reassuring sign, especially with decreased variability
    - ***Action: reposition the mother, oxygen, maternal resuscitations, consider other causes (i.e., fever)***



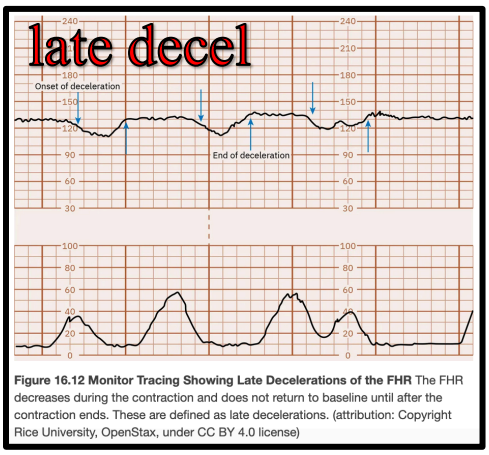
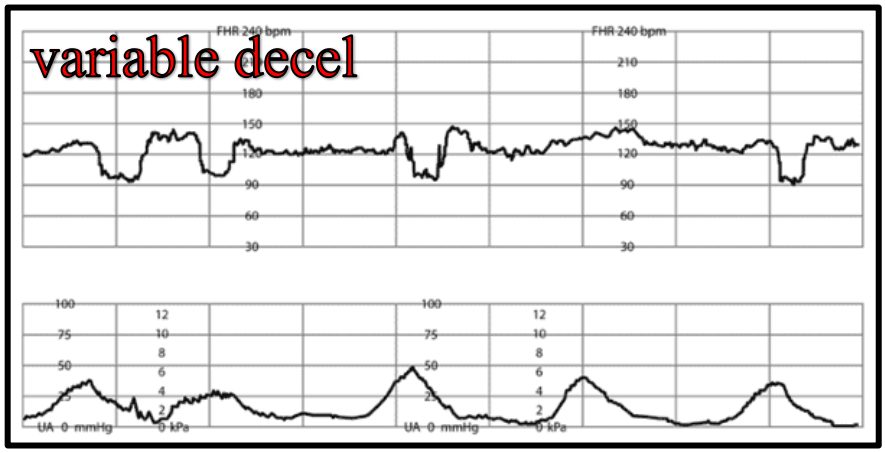


Figure 16.12 Monitor Tracing Showing Late Decelerations of the FHR The FHR decreases during the contraction and does not return to baseline until after the contraction ends. These are defined as late decelerations. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Variable Decelerations
    - Abrupt decrease in FHR; onset to nadir <30s, ≥15s and <2min
    - Most frequent pattern during labor, caused by umbilical cord compression with contraction
    - ***Action: determine if pathological (i.e., prolonged/ slow return to baseline, loss of variability, overshoots FHR on recovery)***
        - ***Reposition the mother as needed***



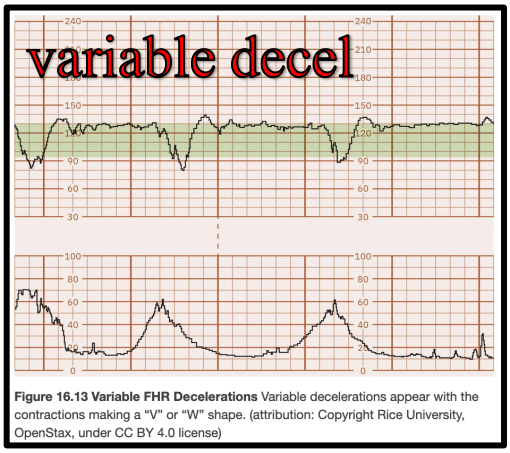
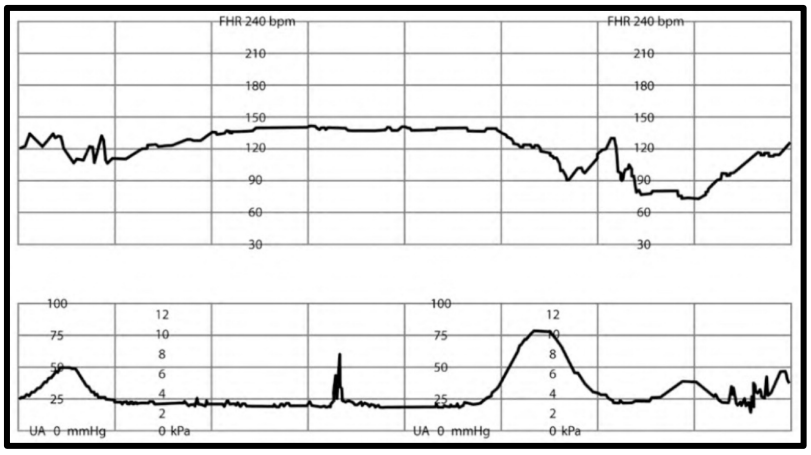


Figure 16.13 Variable FHR Decelerations Variable decelerations appear with the contractions making a "V" or "W" shape. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Prolonged Deceleration
    - Isolated, sporadic decelerations of at least 15 bpm below the FHR baseline that last at least 2min and less than 10min
    - Causes: hypoxia, uterine hyperactivity, cord compression, hypotension, placental abruption, seizure, or impending birth
    - ***Action: consider cause and treat with stopping oxytocin, repositioning mom, oxygen, maternal resuscitation, evaluating for visible prolapsed cord***
        - ***Consider tocolysis with uterine tachystyole***
        - ***Consider emergent delivery if decel persists >3-5min or FHR sustained <80bpm***



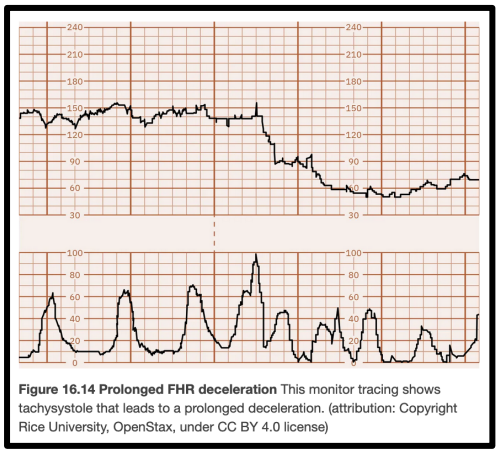
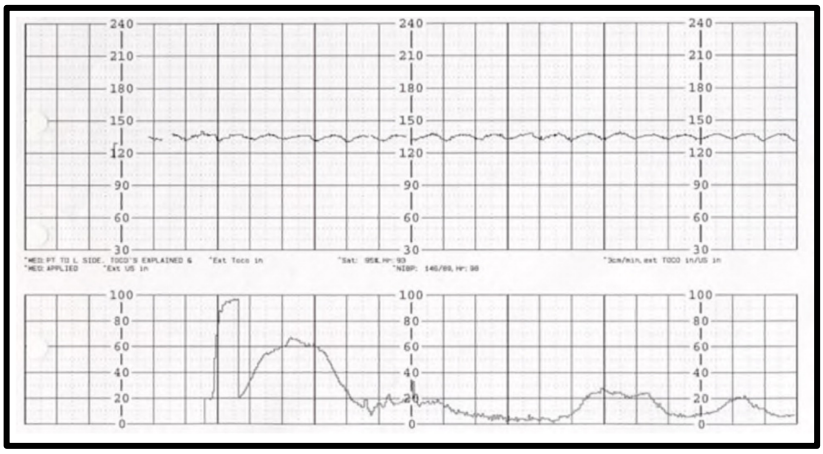


Figure 16.14 Prolonged FHR deceleration This monitor tracing shows tachysystole that leads to a prolonged deceleration. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Sinusoidal Pattern
    - Wave-like FHR pattern with regular frequency (3 to 5 per minute) and amplitude lasting 20min or longer; amplitude 5-15bpm above and below baseline, absent short-term variability
    - Causes: fetal compromise, such as fetal anemia due to loss of blood, and medications administered to the pregnant person.
    - ***Action: consider cause and treat with maternal resuscitation, stopping/ reversing medication (i.e., opioids)***
        - ***Consider emergent delivery if sinusoidal pattern persists***



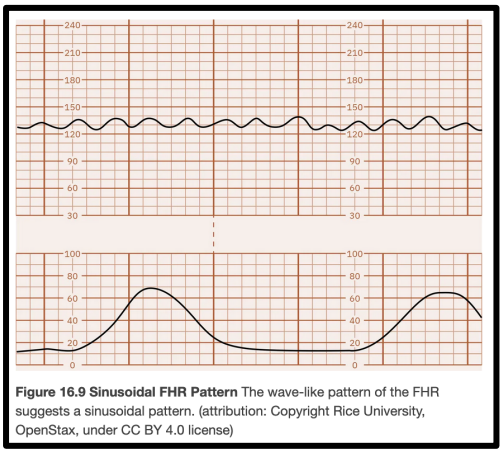


Figure 16.9 Sinusoidal FHR Pattern The wave-like pattern of the FHR suggests a sinusoidal pattern. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

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Arnold, James J, and Breanna L Gawrys. “Intrapartum Fetal Monitoring.” *American Family Physician*, vol. 102, no. 3, Aug. 2020, pp. 158–167, www.aafp.org/pubs/afp/issues/2020/0801/p158.html. Accessed 4 Oct. 2025.

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And then some of the black & white photos are from an old protocol set that is no longer available…